Anesthesia for Neurovascular Embolisation from 1997 - 1999 in Prasat Neurological Institute†

PHUPING AKAVIPAT, M.D., F.R.C.A.T.*

Abstract

Background : Embolisation is another treatment of choice in neurovascular abnormalities. We reported anesthetic data as a basis for further research.

Method : A descriptive retrospective study was performed to evaluate the techniques, drug usage and complications associated with anesthesia in patients who underwent embolisation in the Prasat Neurological Institute within 3 years.

Results : There were 108 cases and 213 procedures. The diagnoses were mainly arteriovenous malformation (56.34%) and carotid cavernous sinus fistula (23%). 74.65 per cent received general anesthesia with endotracheal tube, 11.74 per cent received inhalation anesthesia with laryngeal mask airway, 7.04 per cent received inhalation anesthesia with endotracheal tube and 6.57 per cent received total intravenous anesthesia with laryngeal mask airway. The patients were given anesthesia with thiopental (73.24%), propofol (26.76%) intubated with succinyl choline (69.01%), nondepolarizing muscle relaxant (21.13%) and without any muscle relaxant (9.86%) maintained with oxygen and halothane (63.85%), isoflurane (4.23%) and sevoflurane (25.35%). Fentanyl (87.79%), morphine (1.88%), nalbunorphine (0.47%) were given as narcotics and if a muscle relaxant was required, atracurium (64.79%), pancuronium (5.63%), vecuronium (4.23%) were used. The complications were hypotension (7.04%), anaphylaxis (1.88%), arterial vasospasm (0.47%) and hyperglycemia (1.41%). However, there was no significant statistical difference among the anesthetic techniques and those complications. Post-anesthetic complications within 30 minutes included shivering (3.76%) which was statistically related to the duration of the procedure.

Conclusion : It was concluded that in neurovascular embolisation, there was no need for special techniques or drugs in anesthesia but anesthetic personnel had to optimize the patient's condition for the safety and convenience of neuroradiologists and there should be an awareness of complications eventhough these were not related to anesthetic techniques; further improvement in prevention should be established.

Key word : Neurovascular Embolisation, Anesthetic Drugs, Anesthetic Technique, Complications

AKAVIPAT P
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* Department of Anesthesiology, Prasat Neurological Institute, Bangkok 10400, Thailand.

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Despite an increase in the number of patients with cerebrovascular diseases, surgical treatment is limited along with risky outcomes such as bleeding, infection, neurological deficit or improper post-operative pain control[1-5]. Endovascular embolisation is another treatment of choice which has some advantages over surgery[2-6]. Although both kinds of treatment have been developed to reduce complications risks from anesthesia still exist[7].

Prasat Neurological Institute is a tertiary care institute under the Department of Medical Services. Its main functions are health promotion, prevention, treatment and rehabilitation and it also serves as the neurological center. We have been conducting neurovascular embolisation since 1996 and most of the embolisations have been performed by neuroradiologists under anesthesia. The choices and techniques of anesthesia and drug selection vary according to the condition of the patients, familiarity of the anesthesiologists and satisfaction of the neuroradiologists.

To report and evaluate the choices and techniques of anesthesia, drug usage and complications which occur during that period of time, a descriptive retrospective study was performed in order to adapt and keep the data for futher research in the near future.

MATERIAL AND METHOD

Data from anesthetic, procedure records and history charts of patients who underwent embolisation in Prasat Neurological Institute from October 1st, 1996 to September 30th, 1999 were reviewed. The general data included sex, age, ASA physical status, diagnosis and embolisation technique. The anesthetic data encompassed pre-anesthetic problems, premedications, choice of anesthesia and special techniques, variety of drug usage, monitoring, time spent and complications evolved intraoperatively and 30 minutes post-operatively.

Statistical analysis were Chi's square and Cochran's Q test; Chi's square test for nominal scale among anesthetic techniques, drug usage and complications. Cochran's Q test for nominal scale among related groups in anesthetic time and embolisation time. The data are shown in percentage and standard deviation. (p value < 0.05 was considered significant)

RESULT

There were 213 embolisation procedures in 108 cases, with two cases requiring a combination of embolisation and surgery in the operating theatre because of abnormal vessels and technical difficulty. The treatment frequency ranged from 1 to 7.

Table 1. Demographic data.

Data	Number	%
Sex		
Male	130	61.03
Female	83	38.97
Age (years)		
< 1	1	0.47
1 - 9	23	10.80
10 - 19	28	13.15
20 - 29	64	30.05
30 - 39	40	18.78
40 - 49	34	15.96
50 - 59	17	7.98
> 60	6	2.82
ASA physical status		
I	132	61.97
II	76	35.68
III	5	2.35
IV	0	0.00
V	0	0.00

Table 2. Pre-anesthetic problems.

Pre-anesthetic problems	Episodes
Neurological system	17
Respiratory system	13
Cardiovascular system	13
Hormonal system	7
Hematological system	3
Psychological system	4
Metabolic	1
Others	19

The majority of the patients were male, mean age was 31.74 ± 15.80 years, ASA physical status I - II is detailed in Table 1 (demographic data). The diagnoses were brain arteriovenous malformation (56.34%), carotid cavernous sinus fistula (23%), dural arteriovenous malformation (16.90%), spinal arteriovenous malformation (1.41%), aneurysm (0.94%) and tumour (1.41%) respectively.

There were 51 pre-anesthetic problems in 213 procedures. They involved mainly the neurological system such as paraparesis and increased intracranial pressure, etc. Other problems were in the respiratory system; pulmonary infection, cardiovascular system; myocardial ischemia, arrhythmia, hypertension, hormonal system; diabetes mellitus, psycho-

Table 3. Anesthesia related data.

Data	Number	%
Premedication		
Midazolam	32	15.02
Diazepam	6	2.82
Others	9	4.23
None	166	77.93
Anesthetic technique		
Balanced anesthesia with endotracheal tube	159	74.65
Inhalation anesthesia with endotracheal tube	15	7.04
Inhalation anesthesia with laryngeal mask airway	25	11.74
Total intravenous anesthesia with laryngeal mask airway	14	6.57
Induction agents		
Thiopental	156	73.24
Propofol	57	26.76
Muscle relaxant for intubation		
Succinyl Choline	147	69.01
Atracurium	37	17.37
Vecuronium	6	2.82
Pancuronium	2	0.94
None	21	9.86
Inhalation agents		
Halothane	136	63.85
Isoflurane	9	4.23
Sevoflurane	54	25.35
None	14	6.57
Muscle relaxant for maintenance		
Atracurium	138	64.79
Vecuronium	9	4.23
Pancuronium	12	5.63
None	54	25.35
Narcotics		
Fentanyl	187	87.79
Morphine	4	1.88
Nalbunorphine	1	0.47
None	21	9.86
Supplementation		
Midazolam	42	19.72
Diazepam	1	0.47
Droperidol	3	1.41
Propofol	6	2.82
Others	3	1.41
None	158	74.18

logical system; schizophrenia, hematological system; anemia and others; electrolytes imbalance as shown in Table 2 (preanesthetic problems).

All cases were carried out under general anesthesia with either endotracheal tube insertion or laryngeal mask airway. The details of premedication drugs, induction agents, muscle relaxants, inhalation agents, narcotics and supplementations are shown in Table 3 (anesthesia related data).

Clinical monitoring observed by the anesthetic personnel included non invasive blood pressure, pulse oximetry, electrocardiography, fluid intake and output, tidal volume and airway pressure. End tidal carbon dioxide was recorded 24.88 per cent, blood sugar was measured in diabetic and abnormal blood glucose level patients before induction and hourly after anesthesia. The anesthetic duration ranged between 1.17 and 4.67 hours and embolisation time varied from 0.75 to 3.75 hours as shown in Table 4 (procedure time). Estimated anesthetic time was 47.20 ± 18.15 minutes over the procedure time.

The embolisation agents were glue 58.69 per cent, balloon 20.66 per cent, coils 4.23 per cent

Table 4. Procedure time.

Duration of time (h)	Number related to anesthetic time	%	Number related to embolisation time	%
< 1	0	0.00	20	9.39
1 - 2	102	47.89	131	61.50
2 - 3	89	41.78	54	25.35
> 3	22	10.33	8	3.76

and particles 2.82 per cent. The most frequent anesthetic complication was hypotension (7.04%) which was promptly treated by vasopressor and loading of intravascular fluid. We noticed that it occurred after rapid protamine injection. Two cases (1.88%) developed angioedema after contrast media injections but they recovered completely after taking antihistamine. One episode of seizure (0.47%) occurred after finishing the procedure. Hyperglycemia in diabetic patients was also noted (1.41%). The detected complications were not life threatening except one pediatric patient who had bradycardia and cardiac arrest (0.47%) during intubation. This was immediately solved by cardiopulmonary resuscitation, terminating the stimulation and atropine injection. Heart rate became normal. Post anesthetic follow-up was done and no problems were found. Other complications were bronchospasm (0.47%), arterial vasospasm (0.47%) and post-operative shivering (3.76%).

DISCUSSION

Neurovascular embolisation is an effective treatment with fewer complications than surgery especially for arteriovenous malformation[3,5,7-9]. In Prasat Neurological Institute, we have been employing this technique since 1996 which has reduced the number of surgical patients, the risk of prolonged anesthesia and special anesthetic technique such as intentional hypotensive technique. This study was time limited so in certain cases treatment was not completed and further therapy is expected to continue.

The two basic choices of anesthesia which both have advantages and disadvantages are conscious sedation and general anesthesia[10]. By conscious sedation with monitoring anesthesia, we can detect neurological signs and symptoms directly. But control of respiration and cardiovascular systems are limited as well as patient discomfort. With general anesthesia we were able to control patient movement especially when apnea technique for angiogram or MRI examination was used[11]. In our Institute, we normally use general anesthesia because of the given reasons in conjunction with the preference of neuroradiologists.

There are no special anesthetic techniques needed for this kind of general anesthesia. For patients who undergo a short procedure and do not necessarily need controlled ventilation, we prefer the laryngeal mask airway and inhalation technique which has lower air flow resistance and easy airway management[12-14]. However, it depends on the experience of the anesthesiologists themselves. Induction agents usually used are either thiopental or propofol because of rapid induction and good recovery[15-17]. Succinyl choline was the muscle relaxant of choice for intubation but in some neurovascular diseases it might produce adverse side effects such as hyperkalemia. Non depolarizing muscle relaxant agents were used more often than depolarizing muscle relaxant agents. The inhalation agent was halothane but isoflurane, sevoflurane and short acting narcotics could be used instead because of rapid and smooth recovery in order to facilitate examination of neurological signs immediately after the procedure[18,19]. In over anxious patients we gave the supplementation drug, midazolam, and prolonged emergence afterwards was not seen.

The level of carbon dioxide causing vasodilatation and vasoconstriction during embolisation was necessary and should be monitored by an end tidal carbon dioxide machine[20]. Anesthetic time and procedure time ranged between 1 - 2 hours but anesthetic time was expected to be loner because of the time spent in patient positioning and compressing the artery after decanulation of the femoral artery. There was no statistical significance between complications and choice of anesthetic technique; general anesthesia balanced technique with endotracheal tube, general anesthesia inhalation technique with

endotracheal tube, general anesthesia inhalation technique with laryngeal mask airway and total intravenous anesthesia with laryngeal mask airway. Hypotension was found in dehydrated patients and after a rapid injection of protamine. The possible causes were directly from vasodilatation[21,22] and the process after the effect of histamine release[23-25]. In diabetic patients we found hyperglycemia during anesthesia from glucose in 5 per cent dextrose in half strength normal saline as flushing solution. One study reported alopecia after radiation from prolonged fluoroscope[26].

Post-anesthetic shivering was found by mean of statistical significance with a procedure time over 3 hours. Some studies reported and suggested that the causes might be the lower temperature of the fluid given[27], flushing solution, volume of contrast media, room temperature[28] and the alteration of thermoregulatory control from anesthetic effects[29,30].

SUMMARY

Neurovascular embolisation is an alternative treatment of abnormal vessels in neurology such as arteriovenous malformations and aneurysm, etc.. But this procedure still needs not only neuroradiologists but also anesthetic personnel to observe and take care[7]. Clinical signs should be observed carefully although the occurrences of complications have no statistical significance with the anesthetic technique. Shivering post anesthesia correlated significantly with a procedure time of more than 3 hours. Anesthetic technique and drug usage were not specific and not different from other general anesthesia but we recommend the following

1. Anesthetic personnel must be thoroughly prepared and understand the objectives such as
   - To provide a comfortable environment for the patients, optimal hemodynamic and intracerebral conditions for neuroradiologists and anesthesiologists
   - To safely provide various types of anesthesia.
   - To maintain adequate ventilation.
2. Anesthetic personnel must be well trained for the probable complications that could happen by continuously monitoring the patients.

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การให้ยาระงับความรู้สึกในผู้ป่วยที่มารับการทำเอ็มโบไลเซชัน ภายในสถาบันประสาทวิทยา ตั้งแต่ พ.ศ. 2540 – 2542†

*ภูพิงค์ เอกะวิภาต, พ.บ., ว.ว. วิสัญญีวิทยา.**

การศึกษานี้เป็นการศึกษาย้อนหลังในผู้ป่วยที่มารับการทำ embolisation ภายในสถาบันประสาทวิทยา ตั้งแต่ 1 ตุลาคม พ.ศ. 2540 – 30 กันยายน พ.ศ. 2542 เพื่อที่จะประเมินวิธีการให้ยาระงับความรู้สึก ยาที่ใช้และอาการแทรกซ้อนต่าง ๆ ที่เกิดขึ้นและเกี่ยวข้องกับการให้ยาระงับความรู้สึก มีผู้ป่วยทั้งหมด 108 ราย ทำหัตถการทั้งสิ้น 213 ครั้ง การวินิจฉัยคือ Arteriovenous malformation (56.4%) และ Carotid cavernous sinus fistula (23%) ผู้ป่วยร้อยละ 74.65 ได้รับ general anesthesia ร่วมกับการใส่ท่อช่วยหายใจ ร้อยละ 11.74 ได้ inhalation anesthesia ร่วมกับการใส่ laryngeal mask airway ร้อยละ 7.04 ได้ inhalation anesthesia ร่วมกับการใส่ท่อช่วยหายใจ ร้อยละ 6.57 ได้ total intravenous anesthesia ร่วมกับการใส่ laryngeal mask airway ผู้ป่วยส่วนมากได้ Thiopental (73.24%) เป็นยานำสลบ ส่วนที่เหลือได้ propofol (26.76%) ร้อยละ 69.01 ใส่ท่อช่วยหายใจด้วย Succinyl choline ร้อยละ 21.13 ใส่ด้วย non depolarizing muscle relaxant อีกร้อยละ 9.86 ไม่ได้ใช้ยาหย่อนกล้ามเนื้อช่วยในการใส่ท่อช่วยหายใจ คงระดับความลึกของการให้ยาระงับความรู้สึกด้วย Oxygen ร่วมกับ Halothane (65.73%), Isoflurane (4.23%), Sevoflurane (25.35%) ให้ยา Fentanyl (87.79%), Morphine (1.88%), Nalbunorphine (0.47%) เป็น narcotics และใช้ Atracurium (64.79%), Pancuronium (5.63%), Vecuronium (4.23%) เป็นยาหย่อนกล้ามเนื้อถ้าจำเป็นต้องใช้ อาการแทรกซ้อนที่เกิดขึ้นได้แก่ hypotension (7.04%), anaphylaxis (1.88%), arterial vasospasm (0.47%) และระดับน้ำตาลในเลือดสูง (1.41%) แต่ทั้งนี้ภาวะแทรกซ้อนที่เกิดขึ้นไม่มีความสำคัญทางนัยสถิติกับวิธีการให้ยาระงับความรู้สึก ภาวะแทรกซ้อนที่เกิดขึ้นหลังการให้ยาระงับความรู้สึก ภายใน 30 นาที คือ shivering (3.76%) ซึ่งมีความสัมพันธ์อย่างมีนัยสำคัญกับระยะเวลาในการทำ embolisation โดยสรุป การให้ยาระงับความรู้สึกในผู้ป่วยที่มารับการทำ embolisation ไม่จำเป็นต้องใช้ยาหรือเทคนิคพิเศษอื่น แต่ผู้ให้ยาสลบต้องสามารถควบคุมผู้ป่วยให้อยู่ในภาวะที่ผู้ทำหัตถการสามารถทำได้ด้วยความสะดวก และควรระมัดระวังภาวะแทรกซ้อนต่าง ๆ ที่อาจเกิดขึ้นแม้ว่าจะไม่เกี่ยวข้องกับวิธีการให้ยาระงับความรู้สึกก็ตาม

คำสำคัญ : Neurovascular embolisation, ยาระงับความรู้สึก, วิธีการให้ยาระงับความรู้สึก, ภาวะแทรกซ้อน

ภูพิงค์ เอกะวิภาต
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* กลุ่มงานวิสัญญีวิทยา, สถาบันประสาทวิทยา, กรุงเทพ ฯ 10400

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